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METHOD AND APPARATUS PROVIDING PERFORMANCE IMPROVEMENT FOR GPRS NEIGHBOUR CELL MEASUREMENT REPORTING WHEN PACKET BROADCAST CONTROL CHANNEL IS NOT AVAILABLE

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TECHNICAL FIELD:

This invention relates generally to wireless communications systems and methods and, more specifically, relates to the operation of a mobile station, such as a cellular telephone, with a network that supports general packet radio service (GPRS) operation and cell re-selection (CRS) and measurement reporting functions.

BACKGROUND:

The following additional abbreviations are herewith defined:

3G	Third Generation (cellular system)
3GPP	Third Generation Partnership Project
BA	BCCH Allocation
BCCH	Broadcast Control Channel
BSIC	Base Station Identity Code
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CCCH	Common Control Channel
DSP	Digital Signal Processor
GSM	Global System for Mobile Communications
IP	Internet Protocol
MCU	Micro-Control Unit
MS	Mobile Station
NC	Network Control
PACCH	Packet Associated Control Channel
PBCCH	Packet Broadcast Control Channel

PSI	Packet System Information
UMTS	Universal Mobile Telecommunications System

Reference can also be made, for example, to 3GPP TR 21.905, V4.4.0 (2001-10), Third Generation Partnership Project; Technical Specification Group Services and System Aspects; Vocabulary for 3GPP Specifications (Release 4).

When attached to a GPRS service, the MS can operate in one of the three NC modes, NC0, NC1 or NC2. The network controls the NC mode of the MS via information sent to the MS in broadcast or point-to-point messages.

In the NC0 mode the MS is responsible for selecting the best cell to camp on by performing CRS. In this mode the MS is not required to report the characteristics (received signal quality, etc.) of the surrounding cells to the network. In the NC2 mode the MS does not perform CRS independently, but instead it reports the characteristics of the surrounding cells to the network with a PACKET MEASUREMENT REPORT message. The network can, according to the measurement reports sent by the MS, command the MS to change cells. In the NC1 mode the MS performs both CRS and the measurement reporting.

In 3GPP Release 1999 (R99) the measurement reporting of surrounding 2G cells in the NC1 and NC2 modes is based on the GSM Neighbour Cell list. On the CCCH, the GSM Neighbour Cell list is constructed from the BA(list) (frequency list) broadcast in System Information Type 2/2bis/2ter messages, and from the BSIC list that is broadcast in the System Information Type 2quater message. However, if the BSIC list is not broadcast in the cell, the GSM Neighbour Cell list is defined to be equal to the BA(list) from the System Information Type 2/2bis/2ter messages. For GPRS neighbour cell measurement reporting, the BA(list) from the System Information Type 2/2bis/2ter messages is referred to as BA(GPRS).

When camping on a cell, the MS must acquire the GSM Neighbour Cell list from the system information before it can begin measurement reporting. The System Information 2quater message contains several message instances, and thus receiving the entire

message takes some significant amount of time (up to tens of seconds, depending on the network configuration).

When the MS is moving rapidly the need to change cells occurs quite often, for example once every 15 seconds. However, when in the NC2 mode the network is unable to command the MS to change the cell until the MS has sent measurement reports, because without measurement reports the network does not know to which cell the MS should be assigned. Further, the MS must receive all instances of the System Information Type 2quater message before it is able to construct the GSM Neighbour Cell list. Thus, measurement reporting by the MS can begin only after the reception of the entire SI2quater message. However, the amount of time required to receive the SI2quater message is often so long that it is already too late to change the cell. As a result, the MS can drop out of service when moving outside the service area of the current cell. In practice, this situation is likely to occur, for example, on a highway in an area where the size of the cells is small.

The network could be configured not to use the System Information Type 2quater message, resulting in the GSM Neighbour Cell list being equal to the BA(GPRS) from the System Information Type 2/2bis/2ter messages, as described above. However, several procedures, e.g. GSM-UMTS interworking, require the presence of this message. Thus, eliminating the use of the System Information Type 2quater message is not an acceptable solution from a network configuration perspective.

Prior to this invention, there was no satisfactory solution to the problem described above.

SUMMARY OF THE PREFERRED EMBODIMENTS

The foregoing and other problems are overcome, and other advantages are realized, in accordance with the presently preferred embodiments of these teachings.

In one aspect this invention provides a method that operates, in at least one network control mode of operation (preferably NC2), for determining in the MS if a cell to which the MS is currently assigned has a first type of broadcast control channel (the PBCCH)

and, if the cell does have the first type of broadcast control channel, the method sends a PACKET MEASUREMENT REPORT message to the network for reporting on neighbour cells identified in a list received from the PBCCH. If the cell does not have the PBCCH, the method instead sends a PACKET MEASUREMENT REPORT message to the network for reporting on neighbour cells identified in a list received from a second type of broadcast control channel (BCCH). The type of list used by the MS is one of implicitly specified by the PACKET MEASUREMENT REPORT message (embodiment 1), or is explicitly specified by the PACKET MEASUREMENT REPORT message (embodiment 2).

The list is preferably implicitly specified by sending the message in an earlier version that by default implies the type of list. For example, the PACKET MEASUREMENT REPORT message is sent in a GPRS Release 1997 format that implies a BA(GPRS) from the Broadcast Control Channel (BCCH).

The list is preferably explicitly specified by a field of the PACKET MEASUREMENT REPORT message, such as a one bit field for specifying that the PACKET MEASUREMENT REPORT is based on a BA(GPRS) from the BCCH, or on a GSM Neighbour Cell list from the BCCH. The one bit field is added to the PACKET MEASUREMENT REPORT message only if the PBCCH is not present in the cell.

In further aspects of this invention a computer program product is embodied on a tangible computer-readable medium and includes program instructions for causing a computer of the MS to execute a method of operating with a network, as summarized above.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other aspects of these teachings are made more evident in the following Detailed Description of the Preferred Embodiments, when read in conjunction with the attached Drawing Figures, wherein:

Fig. 1 is a block diagram of a wireless communications system that includes a mobile

station and a network operator, and that is suitable for use in practicing this invention; and

Fig. 2 is a logic flow diagram in accordance with a method of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

By way of introduction, and referring to Fig. 1, there is shown as a simplified block diagram an embodiment of a wireless communications system 10 that is suitable for practicing this invention. The wireless communications system 10 includes at least one MS 100. Fig. 1 also shows an exemplary network operator 20 having, for example, a node 30 for connecting to a telecommunications network, such as a Public Packet Data Network or PDN, at least one BSC 40 or equivalent apparatus, and a plurality of BTSs 50, also referred to as base stations (BSs), that transmit in a forward or downlink direction both physical and logical channels to the MS 100 in accordance with a predetermined air interface standard. A reverse or uplink communication path also exists from the MS 100 to the network operator 20, which conveys mobile originated access requests and traffic. A (macro) cell 3 is associated with each BTS 50, where one cell will at any given time be considered to be a serving cell, while an adjacent cell(s) will be considered to be a neighbour cell. Smaller cells (e.g., picocells) may also be available.

The air interface standard can conform to any suitable standard or protocol, and may enable both voice and data traffic, such as IP data traffic enabling Internet 70 access and web page downloads. In the presently preferred embodiment of this invention the air interface standard is compatible with 3GPP TSs, such as 3GPP TS 04.60 and others, and in at least one embodiment of this invention a modification to the 3GPP TS 04.60.

The MS 100 typically includes a control unit or control logic, such as a MCU 120 having an output coupled to an input of a display 140 and an input coupled to an output of a keyboard or keypad 160. The MS 100 may be a handheld radiotelephone, such as a cellular telephone or a personal communicator. The mobile station 100 could also be contained within a card or module that is connected during use to another device. For example, the mobile station 10 could be contained within a PCMCIA or similar type of

card or module that is installed during use within a portable data processor, such as a laptop or notebook computer, or even a computer that is wearable by the user.

The MCU 120 is assumed to include or be coupled to some type of a memory 130, including a non-volatile memory 130A for storing an operating program and other information, as well as a volatile memory for temporarily storing required data, scratchpad memory, received packet data, packet data to be transmitted, and the like. The operating program is assumed, for the purposes of this invention, to enable the MCU 120 to execute the software routines, layers and protocols required to implement the methods in accordance with this invention (as described in further detail below), as well as to provide a suitable user interface (UI), via display 140 and keypad 160, with a user. Although not shown, a microphone and speaker are typically provided for enabling the user to conduct voice calls in a conventional manner.

The MS 100 also contains a wireless section that includes a DSP 180, or equivalent high speed processor or logic, as well as a wireless transceiver that includes a transmitter 200 and a receiver 220, both of which are coupled to an antenna 240 for communication with the network operator. At least one local oscillator, such as a frequency synthesizer (SYNTH) 260, is provided for tuning the transceiver. Data, such as digitized voice and packet data, is transmitted and received through the antenna 240.

Having thus described one suitable hardware platform for implementing this invention, a more detailed description of the operation of the MS 100 in cooperation with the network operator 20 will now be provided.

In order to decrease the amount of time required to begin measurement reporting by the MS 100, the measurement reporting is based on the GSM Neighbour Cell list only after the MS 100 has received the list, i.e., after it has received the System Information Type 2quater message. Before that time, the measurement reporting is instead based on the BA(GPRS) from the System Information Type 2/2bis/2ter messages. The MS 100 also indicates in each PACKET MEASUREMENT REPORT message which list the measurement report is based on.

This invention may be practiced using at last two embodiments. In a first embodiment, the MS 100 encodes PACKET MEASUREMENT REPORT messages as described in 3GPP R97 GSM standard, as long as the report is based on the BA(GPRS) from the System Information Type 2/2bis/2ter messages.

One significant advantage that is realized by the use of this embodiment is that changes are not required to be made to the air interface in the R99 standard. This is true because the PACKET MEASUREMENT REPORT messages in R97 always refer to the BA(GPRS) from the System Information Type 2/2bis/2ter messages. That is, a R99 compatible network must already understand the format of PACKET MEASUREMENT REPORT messages that are received from R97 compatible MSs.

At first glance it may appear that the use of this embodiment of the invention would prevent the MS 100 from reporting any information that is encoded in the R99 extension part of the PACKET MEASUREMENT REPORT message, as long as it sends PACKET MEASUREMENT REPORT messages encoded according to the R97 standard. However, there currently is no information specified for the MS 100 to encode in the R99 extension until it has acquired the full set of the System Information Type 2quater message. Thus, this apparent disadvantage would only impose a restriction on the PACKET MEASUREMENT REPORT extension in future releases (i.e., releases after R99). However, at present no such extensions have been defined, and a need for such extensions has not yet been identified.

In practice, the implementation of the first embodiment of this invention implies the existence of changes to the 3GPP R99 standard, more specifically to TS 04.60. More specifically still, changes are required to TS version 8.19.0, section 11.2.9 (Packet Measurement Report).

The PACKET MEASUREMENT REPORT message is defined to be sent on the PACCH from the MS 100 to the network 20 to report measurement results. The message may contain measurement results from the Network Control measurements or from Extended measurements, but not both simultaneously. More than one message may be required depending on the number of measurements to report. For a (3G) multi-RAT MS 100, a

report on 3G cells may be included as a result of Network Control measurements.

Table 11.2.9.1 defines the PACKET MEASUREMENT REPORT message content as follows:

```
< Packet Measurement Report message content > ::=
        < TLLI : bit (32) >
        { 0 | 1 < PSI5_CHANGE_MARK : bit (2) > }
        { 0 < NC Measurement Report : < NC Measurement Report struct > >
        | 1 < EXT Measurement Report : < EXT Measurement Report struct > > }
        { null | 0 bit** = < no string > -- Receiver compatible with earlier release
        | 1                              -- Additions in Release 99 :
        { 0 | 1  { 0 < BA_USED : bit > < 3G_BA_USED : bit > | 1 < PSI3 _ CHANGE
_ MARK : bit(2) > } < PMO_USED : bit > } { 0 | 1 < 3G Measurement Report : < 3G
Measurement Report struct > > }      < padding bits > } ;

< NC Measurement Report struct > ::=
        < NC_MODE : bit (1) >
        < RXLEV_SERVING_CELL : bit (6) >
        { 0 | 1 < INTERFERENCE_SERVING_CELL : bit (6) > }
        < NUMBER_OF_NC_MEASUREMENTS : bit (3) >
        {       < FREQUENCY_N : bit (6) >
                { 0 | 1 < BSIC_N : bit (6) > }
                <RXLEV_N:bit(6)> } * (val(NUMBER_OF_NC_ MEASUREMENTS));
< EXT Measurement Report struct > ::=
        < EXT_REPORTING_TYPE: 00 | 01 | 10 >
        { 0 | 1
                { 0 | 1 < I_LEVEL_TN0 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN1 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN2 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN3 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN4 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN5 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN6 : bit (6) > }
                { 0 | 1 < I_LEVEL_TN7 : bit (6) > } }
        < NUMBER_OF_MEASUREMENTS : bit (5) >
        {       < FREQUENCY_N : bit (6) >
                { 0 | 1 < BSIC_N : bit (6) > }
                < RXLEV_N : bit (6) > }* (val(NUMBER_OF_MEASUREMENTS)) ;
< 3G Measurement Report struct > ::=
        < N_3G: bit (3) >
        {       < 3G_CELL_LIST_INDEX : bit (7) >
                < REPORTING_QUANTITY : bit (6) > } * (val(N_3G + 1 )) ;
```

In the foregoing PACKET MEASUREMENT REPORT message content the information elements are all defined in TS version 8.19.0, section 11.2.9 (Packet

Measurement Report).

Of most interest to this invention is the change made to the definition of the NC Measurements. The conventional definition of this field is simply as follows:

"The resulting frequency/cell list for NC Measurements is the GSM Neighbour Cell list, defined in clause 5.6.3.2".

Reference in this regard can be made, for example, to 3GPP TS 44.060, V6.1.0 (2003-02), "Third Generation Partnership Project; Technical Specification Group GSM/EDGE Radio Access Network; General Packet Radio Service (GPRS); Mobile Station (MS)-Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol Release 6", Section 11.2.9, definition of NC Measurements at page 175.

The change to section 11.2.9 that is made in accordance with this embodiment of the invention is as follows:

"In a cell that has a PBCCH, the resulting frequency/cell list for NC Measurements is the GSM Neighbour Cell list, defined in sub-clause 5.6.3.2."

It is noted that the Packet Broadcast Control Channel (PBCCH) is defined for broadcasting packet data specific PSI (Packet System Information). If a PBCCH is not allocated, the packet data specific system information is broadcast instead on the BCCH (Broadcast Control Channel).

The change made in accordance with this embodiment of the invention further states that:

"In a cell that has no PBCCH, the resulting frequency/cell list for NC Measurements is the BA(GPRS) (defined in sub-clause 5.6.3.2) before the MS has acquired the GSM Neighbour Cell list from BCCH. After the MS 100 has acquired the GSM Neighbour Cell list from the BCCH, the resulting frequency/cell list for NC Measurements is the GSM Neighbour Cell list (defined in sub-clause 5.6.3.2)."

Further, the MS 100 is additionally specified to "not include the R99 extension ('additions in Release 99') in the PACKET MEASUREMENT REPORT message which refers to the BA(GPRS)."

The sub-clause 5.6.3.2 of 3GPP TS 04.60 V8.19.0 (2003-07), titled "Deriving BA(GPRS) and the GSM Neighbour Cell list", states the following.

In a cell without a PBCCH allocated, BA(GPRS) is equal to the BA (list) from the SI2/SI2bis/SI2ter messages. BSICs from the GPRS BSIC Description from one or more instances of the SI2quater message (if broadcast) are associated with BA(GPRS) with the same BA_IND value to create the GSM Neighbour Cell list, as described in 3GPP TS 04.18 (sub-clause 3.4.1.2.1.2, "Deriving the GSM Neighbour Cell list from the BSIC and the BA (list)"). If the GPRS BSIC Description is not broadcast, the GSM Neighbour Cell list is equal to BA(GPRS) (only a frequency list).

In a cell with a PBCCH allocated, BA(GPRS) is derived from the neighbour cell parameters sent in PSI3 and ascending order of PSI3bis on PBCCH with the same PSI3_CHANGE_MARK value (see 11.2.20). Each neighbour cell listed in PSI3 and in one or more instances of PSI3bis is assigned an ascending index used for measurement reports. The first neighbour cell in PSI3 has the lowest index (= 0), and the last neighbour cell in the highest indexed PSI3bis message has the highest index. The GSM Neighbour Cell list is equal to BA(GPRS).

Sub-clause 5.6.3.2 further states that the GSM Neighbour Cell list may contain up to 96 GSM Neighbour Cells. The total number of GSM frequencies to measure cannot exceed 32. If the list includes more than 32 frequencies, the MS 100 only measures the 32 frequencies with the lowest indices.

Sub-clause 5.6.3.2 further states that the GSM Neighbour Cell list may be modified by "NC Frequency List" in a PACKET CELL CHANGE ORDER message (in which case the reference list is given on the new cell) or one or more instances of the PACKET MEASUREMENT ORDER message with the same BA_IND value or PSI3_CHANGE_MARK value.

The "NC Frequency List" may add cells to the GSM Neighbour Cell list (see sub-clause 11.2.4 and 11.2.9b, "PACKET CELL CHANGE ORDER" and "PACKET MEASUREMENT ORDER"). These cells are defined to be added at the end of the GSM Neighbour Cell list and indexed in the order of occurrence within the PACKET CELL CHANGE ORDER message, or ascending instances of the PACKET MEASUREMENT ORDER message. The list of added cells may contain GPRS cell re-selection parameters. In case the same cell (ARFCN+BSIC) or the same ARFCN without BSIC occur more than once in the resulting GSM Neighbour Cell list, each occurrence is assigned an index, but only the cell with the highest index is used for cell re-selection and referred to in measurement reports.

Sub-clause 5.6.3.2 further states that the "NC Frequency List" may delete frequencies from the BA(GPRS) list (see 11.2.9b). The frequencies to be removed are identified by their indices in the BA(GPRS). In this case all cells associated with the removed frequencies are removed from the GSM Neighbour Cell list. Removed cells/frequencies keep their indices, but no measurements or reporting are performed. If the index points to a cell that does not exist, this is not considered as an error.

If the MS 100 receives a PACKET MEASUREMENT ORDER message (full set of instances) with a changed PMO_IND parameter value, any old "NC frequency list" is deleted. If the last PACKET MEASUREMENT ORDER message (full set of instances) does not contain a "NC frequency list" (no added or deleted frequencies) the MS 100 returns to BA(GPRS).

Sub-clause 5.6.3.2 states also that in a cell without a PBCCH allocated, if the BA_IND parameter is changed, the MS 100 operates to re-read and rebuild the GSM Neighbour Cell list. In a cell with a PBCCH allocated, and if PSI3_CHANGE_MARK is changed, the MS 100 operates to re-read and rebuild the GSM Neighbour Cell list.

In accordance with this first embodiment of the invention, it is noted that no changes are required to the structure of the PACKET MEASUREMENT REPORT message, as no additional information element or elements need be defined since the source of report is implicitly defined by the encoding the PACKET MEASUREMENT REPORT message.

That is, by not including the R99 extension to the PACKET MEASUREMENT REPORT message (i.e., that part labeled 'Additions in Release 99'), the MS 100 essentially defaults to the PACKET MEASUREMENT REPORT message format (e.g., Release 1997) that is understood by the network 20 to imply the use of the BA(GPRS) from the BCCH. Only after having acquired the GSM Neighbour cell list from the BCCH does the MS 100 begin using the 'Additions in Release 99' portion of the PACKET MEASUREMENT REPORT message.

In the second embodiment of this invention a new field that explicitly indicates the referred list is added to the PACKET MEASUREMENT REPORT message. In the preferred embodiment the new field is a one bit field added to the 'Additions in Release 99' portion of the PACKET MEASUREMENT REPORT message, preferably just before the padding bits. The new field is preferably referred to as the NC_MEAS_LIST_TYPE, and is defined to indicate which list the NC Measurement report is based on, as follows:

0 The report is based on the BA(GPRS).

1 The report is based on the GSM Neighbour Cell list.

The MS 100 is defined to include the NC_MEAS_LIST_TYPE. field in the PACKET MEASUREMENT REPORT message only in a cell that has no PBCCH.

In this regard it is pointed out that the network 20 has knowledge of whether or not there is a PBCCH available in a cell, and can indicate the availability of the PBCCH to the MS 100 in the System Information Type 13 message that is broadcast on the BCCH.

The definition of NC Measurements is preferably also modified as in the first embodiment, i.e., to state in a cell that has a PBCCH, the resulting frequency/cell list for NC Measurements is the GSM Neighbour Cell list, as defined in sub-clause 5.6.3.2 (as set forth above). The change further states that in a cell that has no PBCCH, the resulting frequency/cell list for NC Measurements is the BA(GPRS) (defined in sub-clause 5.6.3.2) before the MS 100 has acquired the GSM Neighbour Cell list from BCCH. After the MS 100 has acquired the GSM Neighbour Cell list from the BCCH, the resulting frequency/cell list for NC Measurements is the GSM Neighbour Cell list (defined in

sub-clause 5.6.3.2). However, this second embodiment does not place the same restriction on the use of the R99 extension in the PACKET MEASUREMENT REPORT message, as does the first embodiment.

An advantage of this embodiment is that the MS 100 is enabled to encode information in the R99 extension part of the PACKET MEASUREMENT REPORT message. While in a R99 compatible MS 100 this is not a direct benefit (as was discussed above), this second embodiment of the invention does not place any restrictions on the use of the PACKET MEASUREMENT REPORT message extension in future releases (releases after R99). However, this advantage is gained at the cost of requiring existing R99 networks to be revised to support this embodiment of the invention, since in this embodiment the source of the report is explicitly signaled by the state of the NC_MEAS_LIST_TYPE bit in the PACKET MEASUREMENT REPORT message.

Referring to Fig. 2, in accordance with a method of this invention to operate the MS 100 with the network 20, the following processes are executed:

A) in at least one network control mode of operation (preferably NC2), determining in the MS 100 if a cell to which the MS 100 is currently assigned has a first type of broadcast control channel (the PBCCH); and

B) if the cell does have the first type of broadcast control channel, sending a PACKET MEASUREMENT REPORT message to the network for reporting on neighbour cells identified in a list received from the PBCCH, specifically the GSM Neighbour Cell list;

C) if the cell does not have the PBCCH, determining in the MS 100 if the GSM Neighbour Cell list has been received;

D) if the GSM Neighbour Cell list has been received, sending a PACKET MEASUREMENT REPORT message to the network for reporting on neighbour cells identified in the GSM Neighbour Cell list received from the BCCH, while indicating the list that was used either implicitly (by sending the R99 PACKET MEASUREMENT REPORT message) or explicitly (by sending the R99 PACKET MEASUREMENT

REPORT message with the field NC_MEAS_LIST_TYPE); or

E) if the GSM Neighbour Cell list has not been received, sending a PACKET MEASUREMENT REPORT message to the network for reporting on neighbour cells identified in the BA(GPRS) received from the BCCH, while indicating the list that was used either implicitly (by sending the R97 PACKET MEASUREMENT REPORT message) or explicitly (by sending the R99 PACKET MEASUREMENT REPORT message with the field NC_MEAS_LIST_TYPE).

This invention also pertains to a computer program that is stored in some type of computer-readable medium(e.g., the memory 130A of Fig. 1) and that is executed by the MCU 120 of the MS 100 for performing the method, as well as to a computer program that is stored in some type of computer-readable medium and that is executed by a suitable data processor of the network 20 for implementing any network-side component or components of this invention.

The use of this invention is advantageous in that it decreases the time required to begin the measurement reporting on the CCCH. In practice, it prevents the MS 100, when moving at high speed in an area with small cell sizes, from dropping out of service when operating in the NC2 mode.

The foregoing description has provided by way of exemplary and non-limiting examples a full and informative description of the best method and apparatus presently contemplated by the inventors for carrying out the invention. However, various modifications and adaptations may become apparent to those skilled in the relevant arts in view of the foregoing description, when read in conjunction with the accompanying drawings and the appended claims. As but some examples, the use of other similar or equivalent message formats, bit definitions, information element and field definitions and formats, as well changes to the specific names for various messages, fields, channels and the like may be attempted by those skilled in the art. However, all such and similar modifications of the teachings of this invention will still fall within the scope of this invention.

Further, while described above primarily in the context of the NC2 mode of operation, it should be appreciated that this invention can also be employed by a MS 100 operating in the NC1 mode. However, in the NC1 mode the MS 100 should not normally drop out of service, since the MS 100 is permitted to autonomously perform CRS. That is, the MS 100 is enabled to change cells without a command from the network 20, thus a late start to the measurement reporting operation does not in and of itself set a restriction on the change of cells.

Further still, some of the features of the present invention could be used to advantage without the corresponding use of other features. As such, the foregoing description should be considered as merely illustrative of the principles of the present invention, and not in limitation thereof.